Claims

1. A particle detector for detecting position of particles, comprising electrodes for detecting position of particles,

said electrodes comprising:

one or more global position detection electrodes for detecting global position of particles; and

a plurality of local position detection electrodes for detecting local position of particles,

wherein the local position within the global position is determined by using the global position detected by said global position detection electrodes and the local position detected by said local position detection electrodes.

2. The detector of claim 1, wherein said plurality of local position detection electrodes are divided into a plurality of groups, and local position detection electrodes belonging to respective groups are connected to common signal lines.

3. The detector of claim 2, wherein a predetermined number of local position detection electrodes correspond to one global position and each electrode of said predetermined number of local position detection electrodes corresponding to one global position belongs to respective different groups.

4. The detector of claim 3, wherein said predetermined number of local position detection electrodes define one period, and said predetermined

number of local position detection electrodes defining one period are repeatedly arranged corresponding to the global position.

5. The detector of any one of claims 1 to 4, wherein said plurality of local position detection electrodes and/or said one or more global position detection electrodes comprise a plurality of pad electrodes.

6. The detector of claim 5, wherein the local position detection electrode is a cathode and the cathode comprises a plurality of local position detection pad electrodes.

7. The detector of claim 6, said particle detector comprises an elongated anode, and said plurality of pad electrodes form an array of pads arranged in series along a lengthwise direction of the anode.

8. The detector of claim 7, wherein the pad arrays are arranged on both sides of the anode,

one pad array comprises a plurality of shortened pad electrodes,

the other pad array comprises a plurality of elongated pad electrodes,

at least said shortened pad electrodes of said one pad array constitute local position detection electrodes,

said shortened pad electrodes constituting the local position detection electrodes are divided into a plurality of groups, and shortened pad electrodes belonging to the same group are connected to respective common signal read lines.

9. The detector of claim 8, wherein the pad electrodes forming pad arrays arranged on both sides of the anode constitute local position detection electrodes.

10. The detector of claim 8, wherein pad electrodes of said one pad array constitute local position detection electrodes, and pad electrodes of said other pad array constitute global position detection electrodes.

11. The detector of claim 10, wherein said plurality of shortened pad electrodes of the pad array constituting the local position detection electrodes are arranged periodically along the lengthwise direction of the anode, and the size of one period corresponds to the size of one elongated pad electrode constituting the global position detection electrode.

12. The detector of any one of claims 1 to 11, wherein the global position is acquired using a charge division method.

13. The detector of claim 12, wherein the global position detection electrode is an anode.

14. The detector of claim 1, wherein said electrodes comprises at least one anode and cathodes provided at both sides of said anode, one cathode comprises global position detection electrodes, and the other cathode comprises local position detection electrodes.

15. The detector of claim 14, wherein the one cathode comprises a plurality of elongated pad electrodes constituting global position detection electrodes, the other cathode comprise a plurality of shortened pad electrodes constituting local position detection electrodes, and a predetermined number of shortened pad electrodes correspond to one elongated pad electrode.

16. The detector of claim 15, wherein each of said predetermined number of shortened pad electrodes corresponding to one elongated pad electrode belongs to respective different groups, shortened pad electrodes belonging to the same group are connected to respective common signal lines, said plurality of elongated pad electrodes are divided into a plurality of groups, and elongated pad electrodes belonging to the same group are connected to respective common signal lines.

17. The detector of claim 15, wherein said plurality of elongated pads have the same dimension and are connected to a common resistance line so as to determine global position using a charge division method, and said predetermined number of shortened pad electrodes corresponding to one elongated pad electrode have the same dimension and are connected to a common resistance line so as to determine local position using a charge division method.

18. The detector of claim 17, two sets of said predetermined number of shortened pad electrodes corresponding to adjacent two elongated pad

electrodes are connected to a common resistance line.

19. The detector of claim 14, wherein each cathode is electrically divided into a first section and a second section each having a plurality of teeth, teeth of the first section and teeth of the second section are arranged in the meshed state in series alternately in a lengthwise direction of the anode, and local position and global position are respectively determined using a charge division method based on surface area ratio between adjacent first section tooth and second section tooth.

20. The detector of claim 19, wherein said adjacent first section tooth and second section tooth constitute a pair of teeth, a global position detection electrode comprises a plurality of teeth pairs, each teeth pair of the same global position have the same surface area ratio, and teeth pairs of different global positions have respective different surface area ratios.

21. The detector of claim 19 or 20, wherein said adjacent first section tooth and second section tooth constitute a pair of teeth, a local position detection electrode comprises a teeth pair, a predetermined number of teeth pairs correspond to one global position, and said predetermined number of teeth pairs corresponding to one global position have respective different surface area ratios.

22. The detector of claim 21, wherein surface area ratios of said predetermined number of teeth pairs corresponding to one global position are

configured to gradually increase or decrease along a lengthwise direction of the anode within the global position.

23. The detector of claim 21 or 22, wherein said predetermined number of teeth pairs define one period, and said predetermined number of teeth pairs defining one period are repeatedly arranged corresponding to a global position along a lengthwise direction of the anode.

24. The detector of claim 21 or 22, wherein two sets of said predetermined number of teeth pairs define one period, and said two sets of said predetermined number of teeth pairs defining one period are repeatedly arranged corresponding to adjacent two global positions along a lengthwise direction of the anode.

25. The detector of any one of claims 1 to 24, wherein said electrodes for detecting position of particles comprise a plurality of elongated electrodes,

said plurality of elongated electrodes are arranged parallel to each other so as to detect position in a direction orthogonal to an lengthwise direction of the elongated electrodes,

each elongated electrode of said plurality of elongated electrodes further comprises a set of a plurality of fine electrodes, said plurality of fine electrodes acquire the same signals at the same time,

at least one fine electrode of the set of fine electrodes constitutes a global position detection electrode, and

at least one fine electrode of the set of fine electrodes constitute a local

position detection electrode.

26. The detector of claim 25, wherein the elongated electrodes are anodes, and each anode comprises a plurality of split anodes extending parallel and adjacent to each other, at least one of said plurality of split anodes constitutes a global position detection electrode, and at least one of said plurality of split anodes constitutes a local position detection electrode.

27. The detector of any one of claims 1 to 26, said detector comprising alternately arranged cathodes and anodes.

28. The detector of any one of claims 1 to 27, said detector is a microstrip gas chamber.

29. The detector of any one of claims 1 to 28, wherein said electrodes for detecting position of particles comprise a multi-layered wiring structure comprising one or more metallic layers constituting electrodes, an insulation layer below said one or more metallic layers, and a metallic wiring layer below said insulation layer, said metallic wiring layer comprises a plurality of read-out signal lines, and said one or more metallic layers constituting the electrodes are electrically connected to selected read-out signal lines.

30. The detector of claim 29, wherein said electrodes are local position detection electrodes.

31. The detector of claim 30, wherein said local position detection electrodes are cathodes, and said one or more metallic layers constituting electrodes are pad electrodes.

32. A method of detecting position of particles using electrodes,

providing electrodes comprising one or more global position detection electrodes for detecting global position of particles and a plurality of local position detection electrodes for detecting local position of particles; and

determining the local position within the global position by the global position detected from said global position detection electrodes and the local position detected from said local position detection electrodes.

33. The method of claim 32, wherein said plurality of local position detection electrodes are divided into a plurality of groups, and local position detection electrodes belonging to respective groups are connected to common signal lines such that signals obtained by local position detection electrodes belonging to respective groups are read out via said common signal lines.

34. The method of claim 33, wherein a predetermined number of local position detection electrodes correspond to one global position and each electrode of said predetermined number of local position detection electrodes corresponding to one global position belongs to respective different groups.

35. The method of claim 34, wherein said predetermined number of local position detection electrodes define one period, and said predetermined

number of local position detection electrodes defining one period are repeatedly arranged corresponding to global positions.

36. The method of any one of claims 32 to 35, wherein said plurality of local position detection electrodes and/or said one or more global position detection electrodes comprise a plurality of pad electrodes.

37. The method of claim 36, wherein the local position detection electrode is a cathode and the cathode comprises a plurality of local position detection pad electrodes.

38. The method of claim 37, said particle detector comprises an elongated anode, and said plurality of pad electrodes form an array of pads arranged in series along a lengthwise direction of the anode.

39. The method of claim 38, wherein the pad arrays are arranged on both sides of the anode,

one pad array comprises a plurality of shortened pad electrodes,

the other pad array comprises a plurality of elongated pad electrodes,

at least said shortened pad electrodes of said one pad array constitute local position detection electrodes,

said shortened pad electrodes constituting the local position detection electrodes are divided into a plurality of groups, and shortened pad electrodes belonging to the same group are connected to respective common signal read lines.

40. The method of claim 39, wherein the pad electrodes forming pad arrays arranged on both sides of the anode constitute local position detection electrodes.

41. The method of claim 39, wherein pad electrodes of said one pad array constitute local position detection electrodes, and pad electrode of said other pad array constitute global position detection electrodes.

42. The method of claim 41, wherein said plurality of shortened pad electrodes of the pad array constituting the local position detection electrodes are arranged periodically along the lengthwise direction of the anode, and the size of one period corresponds to the size of one elongated pad electrode constituting the global position detection electrode.

43. The method of any one of claims 32 to 42, wherein the global position is acquired using a charge division method.

44. The method of claim 43, wherein the global position detection electrode is an anode.

45. The method of claim 32, wherein said electrodes comprises at least one anode and cathodes provided at both sides of said anode, one cathode comprises global position detection electrodes, and the other cathode comprises local position detection electrodes.

46. The method of claim 45, wherein the one cathode comprises a plurality of elongated pad electrodes constituting global position detection electrodes, the other cathode comprise a plurality of shortened pad electrodes constituting local position detection electrodes, and a predetermined number of shortened pad electrodes correspond to one elongated pad electrode.

47. The method of claim 46, wherein each of said predetermined number of shortened pad electrodes corresponding to one elongated pad electrode belongs to respective different groups, shortened pad electrodes belonging to the same group are connected to respective common signal lines, said plurality of elongated pad electrodes are divided into a plurality of groups, and elongated pad electrodes belonging to the same group are connected to respective common signal lines.

48. The method of claim 46, wherein said plurality of elongated pads have the same dimension and are connected to a common resistance line so as to determine global position using a charge division method, and said predetermined number of shortened pad electrodes corresponding to one elongated pad electrode have the same dimension and are connected to a common resistance line so as to determine local position using a charge division method.

49. The method of claim 48, two sets of said predetermined number of shortened pad electrodes corresponding to adjacent two elongated pad

electrodes are connected to a common resistance line.

50. The method of claim 45, wherein each cathode is electrically divided into a first section and a second section each having a plurality of teeth, teeth of the first section and teeth of the second section are arranged in the meshed state in series alternately in a lengthwise direction of the anode, and local position and global position are respectively determined using a charge division method based on surface area ratio between adjacent first section tooth and second section tooth.

51. The method of claim 50, wherein said adjacent first section tooth and second section tooth constitute a pair of teeth, one global position detection electrode comprises a plurality of teeth pairs, each teeth pair of the same global position have the same surface area ratio, and teeth pairs of different global positions have respective different surface area ratios.

52. The method of claim 50 or 51, wherein said adjacent first section tooth and second section tooth constitute a pair of teeth, a local position detection electrode comprises a teeth pair, a predetermined number of teeth pairs correspond to one global position, and said predetermined number of teeth pairs corresponding to one global positions have respective different surface area ratios.

53. The method of claim 52, wherein surface area ratios of said predetermined number of teeth pairs corresponding to one global position are

configured to gradually increase or decrease along a lengthwise direction of the anode within the global position.

54. The method of claim 52 or 53, wherein said predetermined number of teeth pairs define one period, and said predetermined number of teeth pairs defining one period are repeatedly arranged corresponding to a global position along a lengthwise direction of the anode.

55. The method of claim 52 or 53, wherein two sets of said predetermined number of teeth pairs define one period, and said two sets of said predetermined number of teeth pairs defining one period are repeatedly arranged corresponding to adjacent two global positions along a lengthwise direction of the anode.

56. The method of any one of claims 32 to 55, wherein said electrodes for detecting position of particles comprise a plurality of elongated electrodes,

said plurality of elongated electrodes are arranged parallel to each other so as to detect position in a direction orthogonal to an lengthwise direction of the elongated electrodes,

each elongated electrode of said plurality of elongated electrodes further comprises a set of a plurality of fine electrodes, said plurality of fine electrodes acquire the same signals at the same time,

at least one fine electrode of the set of fine electrodes constitutes a global position detection electrode, and

at least one fine electrode of the set of fine electrodes constitute a local

position detection electrode.

57. The method of claim 56, wherein the elongated electrodes are anodes, and each anode comprises a plurality of split anodes extending parallel and adjacent to each other, at least one of said plurality of split anodes constitutes a global position detection electrode, and at least one of said plurality of split anodes constitutes a local position detection electrode.

58. The method of any one of claims 32 to 57, said detector comprising alternately arranged cathodes and anodes.

59. A microstrip gas chamber comprising:

a gas volume;

an electrically insulating substrate provided with a surface facing the gas volume;

cathodes and anodes alternately arranged on the surface of the substrate; and

a high voltage source for creating a potential difference between the cathodes and the anodes,

wherein said cathodes arranged on both sides of the anode are pad arrays comprising a plurality of pad electrodes arranged along a lengthwise direction of the anodes,

one of the pad arrays comprises a plurality of elongated pad electrodes and each elongated pad electrode is connected to a read signal line,

the other of the pad arrays comprises a plurality of shortened pad

electrodes and said plurality of shortened pad electrodes are divided into a plurality of groups, with pad electrodes belonging to the same group being connected to respective common read signal lines, and

position of particles is determined from signals read out by the elongated pad electrodes and the shortened pad electrodes.

60. The microstrip gas chamber of claim 59, said plurality of elongated pad electrodes forming one pad array are respectively connected to independent read signal lines.

61. The microstrip gas chamber of claim 60, wherein said plurality of elongated pad electrodes forming each pad array are divided into a plurality of groups, and elongated pad electrodes belonging to the same groups are connected to common signal lines.

62. The microstrip gas chamber of any one of claims 59 to 61, wherein said anodes are connected to read signal lines such that said anodes detect position of particles in a direction of cathodes, and one dimensional position of particle is determined by signals read out from at least either of said elongated pad electrodes and said shortened pad electrodes and signals read out from said anode.

63. The microstrip gas chamber of any one of claims 59 to 62, wherein said anodes are connected to read signal lines such that said anodes detect position of particles in a direction crossing cathodes, and two dimensional position of

particle is determined by signals read out from said elongated pad electrodes and said shortened pad electrodes and signals read out from said anode.

64. A microstrip gas chamber comprising:

a gas volume;

an electrically insulating substrate provided with a surface facing the gas volume;

cathodes and anodes alternately arranged on the surface of the substrate; and

a high voltage source for creating a potential difference between the cathodes and the anodes,

wherein each anode is an anode set comprising a plurality of fine anodes extending parallel and adjacent to each other, said anode set is adapted to detect position in a direction orthogonal to an lengthwise direction of the anode,

at least one fine anode of said plurality of fine anodes of respective anode sets is divided into a plurality of groups, fine anodes belonging to the same group are connected to respective common local position read signal lines,

at least one fine electrode of said plurality of fine anodes of respective anode sets is connected to a common global position read signal line,

and position of incident particles is determined using read signals acquired from the local position read signal line and the global position read signal line.

65. The microstrip gas chamber of claim 64, wherein fine anodes of

respective anode sets for determining the global position are divided into a plurality of groups, fine anodes belonging to the same group are connected to respective common local position read signal lines.

66. A microstrip gas chamber comprising:

a gas volume;

an electrically insulating substrate provided with a surface facing the gas volume;

at least one anode provided on said surface of the substrate;

cathodes provided at both sides of said anode; and

a high voltage source for creating a potential difference between the cathodes and the anodes,

wherein one cathode on one side of said anode constitutes a global position detection electrode,

the other cathode on the other side of said anode constitutes a local position detection electrode,

the local position within the global position is determined by using the global position detected by said global position detection electrodes and the local position detected by said local position detection electrodes.

67. The microstrip gas chamber of claim 66, wherein said one cathode comprises a plurality of elongated pad electrodes constituting global position detection electrodes, said other cathode comprise a plurality of shortened pad electrodes constituting local position detection electrodes, and a predetermined number of shortened pad electrodes correspond to one

elongated pad electrode.

68. The microstrip gas chamber of claim 67, wherein each of said predetermined number of shortened pad electrodes corresponding to one elongated pad electrode belongs to respective different groups, shortened pad electrodes belonging to the same group are connected to respective common signal lines, said plurality of elongated pad electrodes are divided into a plurality of groups, and elongated pad electrodes belonging to the same group are connected to respective common signal lines.

69. The microstrip gas chamber of claim 67, wherein said plurality of elongated pads have the same dimension and are connected to a common resistance line so as to determine global position using a charge division method, and said predetermined number of shortened pad electrodes corresponding to one elongated pad electrode have the same dimension and are connected to a common resistance line so as to determine local position using a charge division method.

70. The microstrip gas chamber of claim 69, two sets of said predetermined number of shortened pad electrodes corresponding to adjacent two elongated pad electrodes are connected to a common resistance line.

71. The microstrip gas chamber of claim 66, wherein each cathode is electrically divided into a first section and a second section each having a plurality of teeth, teeth of the first section and teeth of the second section are

arranged in the meshed state in series alternately in a lengthwise direction of the anode, and local position and global position are respectively determined using a charge division method based on surface area ratio between adjacent first section tooth and second section tooth.

72. The microstrip gas chamber of claim 71, wherein said adjacent first section tooth and second section tooth constitute a pair of teeth, a global position detection electrode comprises a plurality of teeth pairs, each teeth pair of the same global position have the same surface area ratio, and teeth pairs of different global positions have respective different surface area ratios.

73. The microstrip gas chamber of claim 71 or 72, wherein said adjacent first section tooth and second section tooth constitute a pair of teeth, a local position detection electrode comprises a teeth pair, a predetermined number of teeth pairs correspond to one global position, and said predetermined number of teeth pairs corresponding to one global positions have respective different surface area ratios.

74. The microstrip gas chamber of claim 73, wherein surface area ratios of said predetermined number of teeth pairs corresponding to one global position are configured to gradually increase or decrease along a lengthwise direction of the anode within the global position.

75. The microstrip gas chamber of claim 73 or 74, wherein said predetermined number of teeth pairs define one period, and said predetermined number of

teeth pairs defining one period are repeatedly arranged corresponding to a global position along a lengthwise direction of the anode.

76. The microstrip gas chamber of claim 73 or 74, wherein two sets of said predetermined number of teeth pairs define one period, and said two sets of said predetermined number of teeth pairs defining one period are repeatedly arranged corresponding to adjacent two global positions along a lengthwise direction of the anode.